Portrayal of hearing loss in YouTube videos: An exploratory cross-sectional analysis

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Abstract

Objective: The objective of the current study was to examine the source, content, understandability and actionability of hearing loss information on YouTube videos.

Method: The study used a cross-sectional design. One hundred of the most frequently viewed YouTube videos were identified and various data were manually coded (i.e., video source, video content, popularity measures such as number of views, likes, and dislikes). In addition, the understandability and actionability of each video were evaluated using the Patient Education Materials Assessment Tool for Audiovisual Martials (PEMAT-AV) rating scale.

Results: Of the 100 most viewed videos, 16 were created by consumers, 62 were professional-created, and 22 were media-based. Symptoms, causes and treatment or management of hearing loss were the most frequently discussed content categories with over 60% of all videos commenting on these areas. The overall understandability and actionability scores for the 100 videos included were 77% and 31% respectively indicating adequate understandability and poor actionability.

Conclusions: The YouTube videos on hearing loss focus on a range of issues. The poor actionability of these videos was a concern as these videos may not lead to appropriate consumer

actions in addressing their hearing loss. Efforts are needed to improve the quality and content of these videos to promote appropriate behavior change.

Key Words

Hearing loss, Hearing impairment, Hearing disability, Internet health information, Social media, YouTube

Introduction

Hearing loss is the most common sensory impairment and affects approximately 466 million individuals of all ages (World Health Organization, 2019). It negatively affects quality of life due to the direct impact on speech recognition and communication abilities (Hällgren et al. 2005). Further, the presence of hearing loss contributes to social isolation and feelings of loneliness (Burton-Shepherd, 2015). Individuals with hearing loss can greatly benefit from interventions aimed at minimizing these effects. However, not all individuals are aware that such interventions exist unless presented with accurate advice and information regarding the availability of such options.

The Internet has become an integral element of everyday life for the vast majority of the population (Amichai-Hamburger, 2005). Due to the ease of accessing Internet-based information, many individuals of all ages turn to the Internet before other sources for information, including healthcare information (Forczek et al., 2015; Fox & Duggan, 2013). The National Health Interview Survey, published in 2015, reported that 44% of 32,139 adults used the Internet to search for health-related information (Amante, Hogan, Pagoto, English, and

Lapane, 2015). Individuals with hearing loss also turn to the Internet for information and support regarding the intervention options available to them (Laplante-Lévesque et al., 2012) and seek information for social support and relationship building (Ghiamatyoon, Nesayan, & Movallali, 2016; Simpson et al., 2018).

Online health information and support is available from a variety of organizations, individuals, and platforms (i.e., Internet websites, YouTube, Twitter, Facebook). The source of the information is especially important because this may have a compelling effect on health-related practice and decisions (Simpson et al. 2018). This presents individuals with significant challenges in assessing and choosing sources, and more explicitly, in determining the credibility and reliability of the sources (Corritore et al., 2012; Metzger & Flanagin, 2013). Since the rise of the Internet, concerns have been raised about the quality of health information from Internet-based sources from professionals and other stakeholders (Greenberg, D'Andrea, & Lorence, 2004). Online information and support can have varying quality, accuracy, and reliability (Eysenbach & Köhler, 2002; Kitchens et al., 2014). Finally, the manner with which individuals use the various electronic media platforms for health information for self-management or health decision making may be different (Bellon-Harn et al., 2019).

Oversight to verify the appropriateness of online content is needed. Unfortunately, there are limited mechanisms to ensure a high-quality standard and accurate reporting of health information online. The responsibility to determine the quality of health-related content falls to the individual sites (World Health Organization, 2018). In the area of hearing health care, the most frequently evaluated online information is text-based information on websites. Research

indicates that the quality and readability of Internet-based information for tinnitus (Manchaiah et al., 2019) and hearing loss is poor (Laplante-Lévesque et al., 2012). Further research has been undertaken to examine tinnitus (Manchaiah, Ratinaud & Beukes, 2019) and hearing health care information from wider sources such as the newspaper media and social media (Manchaiah, Ratinaud & Andersson, 2018). This work has highlighted the need to have a greater understanding of the portrayal of hearing health information where it is most sought by consumers.

Due to the engaging nature of video formats, many people seek video-based information before text-based information. YouTube is currently the most popular online video sharing site and the second most visited Internet site and social media platform (Clement, 2019). It is also a common outlet for health-related information to be shared by professionals, health organizations, and/or patients and facilitates user interactions through commenting, responding, and messaging options (Duke et al., 2019; Wong et al., 2016). A recent study that examined the media usage by older adults with hearing loss suggested that YouTube was the most frequently used social media platform, although nearly half of the study participants reported that they find it extremely hard to find hearing health information in YouTube videos (Manchaiah et al., 2020a). Content analysis of YouTube information has repeatedly indicated variable unregulated quality for numerous health care concerns, including diabetes and infection preventing. A systematic review by Madathil et al. (2015) found that the quality of YouTube videos regarding health care information was variable with information from government organizations and professional associations containing higher quality information and being more trustworthy. Although, not all studies on YouTube have examined the quality of information, the video content can be coded,

and expert panel can determine the trustworthiness of the information. A lot of misleading information was also found and often retrieved more readily by the lay user due to the search terms they use (Madathil et al., 2015). These findings highlighted the need for ways to support consumers in the critical evaluation of information posted on YouTube to assist them in making effective healthcare decisions.

To date, the information regarding hearing loss portrayal on wider sources such as video sharing has been limited. Specifically, three studies have examined the content of hearing health information in YouTube videos. These studies have examined the content, understandability, and actionability of video-based Internet information. Understandability is conceptually defined as the ability of people from diverse backgrounds with varying health literacy abilities to comprehend educational materials and extract key messages (Zuzelo, 2019). Actionability refers to the ability of learners to identify what actions can be taken on the basis of educational material information (Zuzelo, 2019). A study by Basch et al. (2018) examined information about tinnitus contained in the most widely viewed videos on YouTube and source upload of the videos. Of the most frequently viewed 100 videos, most were uploaded by consumers (i.e., 42%), which mainly consisted of personal experiences. However, the authors did not include measures of understandability and actionability of video information. In another recent study, we examined the source, content, understandability and actionability of YouTube videos related to hearing aids (Manchaiah, Bellon-Harn, Michelles, Vinay, & Beukes, 2020b). The study highlighted that YouTube videos related to hearing aids included general information about hearing aids (e.g., hearing aid types, and handling and maintenance) with over 50% of all videos commenting on these areas. There were some differences in content categories across video source types (i.e.,

consumer, professionals, and media). Moreover, the overall understandability scores were found to be adequate, although the actionability scores fell short of being adequate. These findings suggest that the YouTube videos may provide some relevant information, although they may not have bearing towards users' actions in terms of hearing aid use. Nevertheless, we are not aware of any studies that have examined the content of videos related to hearing loss.

The aim of the study is to investigate and analyze the information that is readily available via 100 most frequently viewed English language videos on YouTube pertaining to hearing loss. The specific aims were to: (1) identify the sources and popularity of the videos uploaded; (2) examine the types of content the videos included; and (3) evaluate the understandability and actionability of the videos. This study contributes to existing work in hearing health care that examines information from various sources (e.g., news media, social media) to which clients are exposed in an effort to understand their knowledge, attitudes, behaviors. In turn, this may help in developing appropriate and evidence-based online information for general public including the service users (Eysenbach, 2009, 2011).

Method

Study Design

This study employed a cross-sectional design and analysis of publicly available YouTube videos. The study design followed a similar design to those by previous studies YouTube studies on other health areas (e.g., Basch et al., 2017, 2018; Bellon-Harn et al., 2019; Manchaiah et al., 2020b). This study did not require ethical approval as it did not involve human subjects.

Data Extraction and Assessment of Video

Search Criteria and Inclusion Criteria

The search was focused on identifying and examining the 100 most frequently viewed English language videos that provided information that would be valuable, informative, and useful to individuals with hearing loss. Videos were included if they targeted the hearing impaired population regarding symptoms, causes, effects, treatment, acceptance, experiences or simulations living with hearing loss. Due to the wide inclusion criteria broad search terms of 'hearing loss' and 'hearing impairment' were used. This strategy allowed a large selection of commonly found videos related to hearing loss to be captured. These key words were entered in the YouTube search bar and each video was examined for inclusion until we found 100 videos that met the inclusion criteria. It is noteworthy that YouTube presents search results differently depending on the (a) type of Internet browser, (b) time of search, and (c) if the researchers have logged in to their personal YouTube (or Gmail) account. Hence, to minimize the user-targeted search results the browser history was deleted, cookies were cleared, and the search was performed in a private mode on the Mozilla Firefox browser (Version 62.0.3). This step was necessary to reduce search related bias.

During the search process, a total of 109 videos were excluded. These included 18 non-English videos. In addition, 91 videos were excluded for the following reasons: (a) Deaf culture or sign language (n=2); (b) ear cleaning including ear wax or foreign objects removal (n=14); (c) surgical procedures (n=7); (d) home remedies or cure for hearing loss (n=40); (e) main focus on hearing symptoms such as tinnitus rather than hearing loss (n=3); (f) spoke about hearing aids and other assistive technologies (n=15); and (g) were related to hearing loss but, did not have

significant information about hearing loss (n=10). However, videos with personal stories of experiences living with hearing loss and hearing loss simulations were included as they may provide valuable information for people with hearing loss.

Extracting Video Popularity Measures

Once the sample of 100 videos were developed, basic descriptive data was extracted, which included: the title, uniform resource locator (URL), date of upload, video duration, total number of views of the video, as well as the number of thumbs up (likes) and thumbs down (dislikes). The popularity-based meta-data (e.g., number of views, likes, dislikes) provides an indication of performance (i.e., how well the users have engaged with the videos). The content and quality of videos may be key in determining how the users relate to the videos. Hence, the popularity measures may provide some information about the quality and reliance of the videos. Moreover, quality and content of videos may vary based on their source. For instance, professionals will have more subject matter expertise, whereas the consumers will have their personal experiences. These aspects may have bearing towards the way in which the users may relate to their videos and may influence the popularity of the videos. For these reasons, examining the relation between the video source and popularity-based measures related to YouTube videos may be interesting. Some meta-data (e.g., video duration) relative to other meta-data (e.g., thumbs up, thumbs down) may provide information regarding how populations interact with the videos during searches or viewing (Van den Eynde et al., 2019).

Coding the Video Source and Content

The content of each video was categorized and coded to identify the source and content.

Source Coding: The sources of uploads were recorded and grouped into the following categories: (1) consumer (i.e., member of the lay public), (2) professional (i.e., a credentialed person, qualified to discuss the topic, professional body); or (3) media (i.e., any clip that originated from an Internet channel or website).

Content Coding: The videos were coded by considering information that would be valuable, informative, and useful to individuals with hearing loss. The following content categories were identified from fact sheets from American Academy of Audiology (AAA), American Speech-Language Hearing Association (ASHA), Hearing Loss Association of America (HLAA), and national Institute on Deafness and Other Communication Disorders (NIDCD):

1. *Hearing mechanism:* explanations of the auditory system and the sensation of hearing in both normal and abnormal auditory systems.
2. *Types and degree of hearing loss:* classifications regarding whether the hearing loss is conductive, sensorineural, or mixed type of hearing loss, and/or degree of hearing loss (e.g., mild, moderate, serve).
3. *Symptoms of hearing loss:* descriptions of possible symptoms such as tinnitus, listening to television or radio at high volume, difficulty understanding speech in group or noisy situations, or avoiding social situations.
4. *Medical or genetic conditions associated with hearing loss:* explanations regarding causes such as middle ear (e.g., cholesteatoma, chronic suppurative otitis media), inner ear conditions (e.g., Ménière's disease, Auditory Processing Disorders, Auditory Neuropathy Spectrum Disorders) or syndromes (e.g., Down's syndrome).

5. *Causes of hearing loss:* outlining different ways an individual can develop hearing loss such as presbycusis, exposure to loud noise, ototoxic medications, etc.
6. *Effects of hearing loss on development:* highlighting how hearing loss affects child development, how hearing loss affects cognitive processes, and how hearing loss may affect daily life and work, communication, emotions, and relationships.
7. *Consequences of hearing loss on individual's life and work:* accounts regarding the effects of hearing loss on an individual's daily life (physical, mental and emotional issues such as self-identity, communication, relationships, social life) and work (e.g., work ability, work performance).
8. *Consequences of hearing loss on communication partners:* descriptions regarding the impact of hearing loss on frequent communication partners.
9. *Diagnosis or confirmation of hearing loss:* explanations regarding self-testing, methods and clinical assessment to confirm hearing loss.
10. *Treatment or management of hearing loss:* coverage regarding available options such as a hearing aid; implantable devices; assistive listening devices; counseling including communication strategies such as lip reading; medication; acoustic neural stimulation; nutritional supplements.
11. *Acceptance and coping:* outlining experiences of living with hearing loss including acceptance, adjustment and coping.
12. *Hearing loss prevention*: guidelines regarding hearing care and conservation of hearing.
13. *Featuring a celebrity* with hearing loss: features that raise public awareness of hearing loss.

Assessment of Understandability and Actionability

The Patient Education Material Assessment Tool (PEMAT) is a reliable quality assessment tool. The PEMAT is a free, publicly available tool developed for the Agency for Healthcare Research and Quality to assess understandability and actionability of patient education materials (Shoemaker, Wolf, & Brach, 2014). Understandability refers to health information that can be understood by health consumers from diverse backgrounds and with varying levels of health literacy. Actionability refers to health information that enables patients to easily identify what they need to do. Strong internal consistency, reliability, and construct validity of PEMAT have been reported (Shoemaker, Wolf, & Brach, 2014). PEMAT has been recently used to evaluate information directed at a patient audience (e.g., Balakrishnan et al., 2016; Lambert et al., 2017).

The understandability and actionability of each YouTube video were evaluated using the PEMAT for Audiovisual Materials (PEMAT-AV; Agency for Healthcare Research and Quality, 2013). The PEMAT-AV has 17 items and it is specifically designed to access audiovisual materials such as YouTube videos. Thirteen items are related to understandability and 4 items are related to actionability. Each item is scored as agree (i.e., 1), disagree (i.e., 0), or not applicable (i.e., N/A). Of the 13 items related to understandability, item 12 was not included [i.e., The material uses visual cues (e.g., arrows, boxes, bullets, bold, larger font, highlighting) to draw attention to key points] because per the PEMAT-AV instruction, this item is not applicable for all videos. Item 19 (i.e., The material uses simple tables with short and clear row and column headings) was not included because no tables were included on any videos.

The percentage understandability and actionability sub-scale scores were calculated by dividing the number of items which scored 1 (i.e., agree) by number of items rated. Items that were identified as not applicable were not included in the calculation. For example, for a specific video, if 10 out of 13 items in the understandability sub-scale were rated and 3 were not applicable, the calculation would include 10 total items rated. Of the 10, if 5 items were rated as agree, the understandability score would be 50% (i.e., score of 5 from 10 items rated, 5/10=50). Higher understandability and actionability are indicated by higher percentages. Scores under 70% indicate that the information has poor understandability or actionability (Shoemaker et al., 2014).

Quality assessment was initially independently undertaken by two doctoral students in audiology. They familiarized themselves with PEMAT-AV by studying the user's guide provided by the Agency for Healthcare Research and Quality (2013). The 5 steps presented on the guide were followed. To calibrate responses, they initially evaluated 10 videos within the area of speech and hearing sciences (i.e., aphasia) using the PEMAT-AV. Once calibration was demonstrated one student analyzed all 100 videos and the other student completed analysis of 20% of the videos.

Data Analysis

Statistical analysis was conducted using the IBM SPSS Software Version 24. Manually coded video content was converted into multiple binary variables (i.e., coded as 0 if video did not include information about a specific category and coded as 1 if the video did present information about a specific category). Descriptive statistics were used to summarize the mean, median,

297 standard deviation, and standard error regarding meta-data (i.e., number of views, duration of
298 videos, thumbs up, thumbs down) of the included videos. Normality tests were performed on the
299 videos meta-data and PEMAT-A/V scores (i.e., understandability sub-scale scores, actionability
300 sub-scale scores). The Shapiro Wilk test and also visual examination of normality plots
301 suggested that all of these variables violated the assumption of normality. Hence, non-parametric
302 tests were used for further analysis.
303
304 Chi squared analysis was used to identify whether significant differences existed regarding the
305 video content provided by the various video sources. The Kruskal-Wallis H test was used to
306 examine if the meta-data and the PEMAT-A/V scores varied across the video source (i.e.,
307 consumer, professional, Internet-based). A pairwise analysis was performed using the Bonferroni
308 Post Hoc test for the variables that found significance in the Kruskal-Wallis H test. Spearman's
309 correlation was performed to examine the correlation between videos' meta-data. A single-
310 measurement, consistency-agreement Intraclass Correlation Coefficient (ICC) was used to
311 examine the inter-rater reliability for PEMAT-A/V sub-scale ratings. A significance level of 0.05
312 was used for interpretation of results and Bonferroni correction applied to account for multiple
313 comparisons.
314

315 # Results

316 **Video Source and Popularity**

317 The sources of the videos were identified as professional (n = 62), consumer (n = 16) and media-
318 based (n =22). Table 1 presents the descriptive data of the popularity-based meta-data for these
319 videos for different video sources. The average number of views of the videos was 42,066 (range

of 7,922 to 487,297 per video). The mean duration of videos was 4:47 minutes with the shortest video being 18 seconds and the longest video being 36 minutes and 57 seconds. The mean number of thumbs-up (likes) and thumbs-down (dislikes) for these videos were 227 and 8 respectively.

<Table 1 near here>

Kruskal-Wallis H test was performed to examine if the meta-data differed between video sources. No significant differences were found for number of views (Chi square=1.14, p=0.56), thumbs-up (Chi square=1.79, p=0.41) and thumbs-down (Chi square=.45, p=0.79) between video sources. For video duration, a significant difference was found (Chi square=7.31, p=0.026), but these results are not considered significant when interpreted using Bonferroni corrected significance level for multiple comparisons.

Spearman's rho correlation test was performed to examine the relationship between meta-data. The number of views had moderate positive correlation with thumbs-up (r=0.63, $p\leq$0.01) and thumbs-down (r=0.63, $p\leq$0.01). Thumbs-up had strong positive correlation with thumbs-down (r=0.71, $p\leq$0.01). These results are expected as the most frequently viewed videos are more likely to receive thumbs-up and thumbs-down. Video duration had a small positive correlation with thumbs-up (r=0.25, $p\leq$0.01) suggesting that the longer duration videos were viewed favorably from viewers.

Video Content and Purpose

The content of included videos is found in Table 2. Symptoms, causes and treatment or management of hearing loss were the most frequently discussed content categories with over 60% of all videos commenting on these areas. Only a few videos (i.e., around or below 25%) commented the effects of hearing loss on development, diagnosis or confirmation of hearing loss, and hearing loss prevention. Overall, these results suggest that the YouTube videos related to hearing loss cover range of issues. Also, some differences and similarities were noted in video content across video sources. The Chi square analysis showed no association between video source and nine of the video content themes (see Table 2). However, there was a significant association between video source and the themes hearing mechanism (p=0.001), type and degree of hearing loss (p=0.003), consequences of hearing loss on individual's life and work (p=0.006), acceptance or coping (p<0.001), and featuring a celebrity (p=0.004).

<Table 2 near here>

Understandability and Actionability

ICC for understandability and actionability sub-scales were 0.81 and 0.74 respectively suggesting good inter-rater reliability for PEMAT-A/V. Table 3 presents the descriptive statistics for the PEMAT-A/V individual items ratings. With regard to understandability, videos stated a purpose (i.e., Item 1), used common everyday language (i.e., Item 3), used active voice (i.e., Item 5), broke information into small sections (i.e., Item 8), presented information in a logical sequence (i.e., Item 10), and allowed the user to hear the words clearly (i.e., Item 15) with adequate scores. All other items in the understandability section did not reach the adequate level (i.e., 70%). No items in the actionability section met an adequate level.

<Table 3 near here>

Table 4 presents the descriptive statistics of PEMAT-A/V scores across video source categories. Scores closer to 100% indicate greater understandability and higher actionability. The overall understandability and actionability scores for the 100 videos included were 77% and 31% respectively. Overall these scores indicate adequate understandability and poor actionability. The results of Kruskal-Wallis *H* test showed that there is a significant difference in understandability scores between videos from different sources (Chi square = 11.61, p=0.003), but no significant difference in actionability scores between videos from different sources (Chi square = 2.04, p=0.36). The pairwise comparisons of understandability scores with Bonferroni Post Hoc tests showed that professional videos had significantly higher understandability scores when compared to media videos (p=0.007). These results suggest that videos developed by professionals were easier for consumer to understand when compared to videos made by the media sources. However, no other significant differences were found.

<Table 4 near here>

Discussion

Professionals should be aware of clients and families increased reliance on the Internet, including YouTube, to seek out information and support. In light of the fact that individuals with hearing loss seek information and support from the Internet, this study sought to examine the source, content, understandability and actionability of hearing loss related information contained in

different videos uploaded to YouTube. Results indicated that for the 100 most frequently viewed videos, the number of views was over 4 million and viewers overwhelmingly liked the videos. The majority of videos were created by professionals and were viewed more frequently than other videos, albeit not statistically different compared to videos made by consumers or the media. Although Gabarron et al. (2013) suggested that meta-data may not be a useful measure, the comparison of views across video source provides some valuable information. As noted by Madathil et al. (2015) videos from professionals may contain more trustworthy information than other sources. In the current study, more professional videos were uploaded and viewed. However, the current study showed that no relationship exists between video source and meta-data such as number of views, video duration, thumbs-up, and thumbs-down in hearing loss YouTube videos. These results suggest that video popularity does not depend on the source. These findings are not consistent with Basch et al. (2018) who reported that the most popular videos related to tinnitus were from consumers.

Content of YouTube Videos Pertaining to Hearing Loss

Overall, results suggest that the YouTube videos related to hearing loss cover a range of issues with an emphasis on symptoms, causes and treatment or management of hearing loss. Some differences across video sources were noted. Content categories such as hearing mechanisms and type and degree of hearing loss were more popular with professionals, whereas consumer uploads more often discussed categories such as consequences of hearing loss on individual' life and work, consequences of hearing loss on communication partners, and also acceptance or coping. On the other hand, videos created by the media were focused on discussing causes of hearing loss or featured a celebrity with hearing loss sharing their experiences. The source of

information thus contributes to different types of information which can affect the impact the information has on the provider (Simpson et al. 2018). It may be that consumers (i.e., members of the lay public) are more interested in the psychosocial aspects of hearing loss. Also, the video content of consumers are unique as they focus on their personal experiences. For example, Basch et al. (2018) reported that consumers uploaded personal information related to tinnitus more frequency than other sources. In our recent study, we examined YouTube videos about hearing aids and noted that consumer videos included more comprehensive videos about hearing aid purchasing process than professional and media-based videos (Manchaiah et al., 2020). These observations highlight the fact that one type of content is not better than other, rather the scope of the videos from different sources provide different information. Interestingly, only 16 of the 100 videos were uploaded by consumers. Moreover, the type of electronic media platform may influence its function for the end-user (Bellon-Harn et al., 2019). The lay public may be using other platforms to engage in the digital conversation regarding psychosocial issues.

Understandability and Actionability of YouTube Videos Pertaining to Hearing Loss

The current study showed that the YouTube videos related to hearing loss had adequate understandability (i.e., 77%), but videos did not meet the threshold for adequacy in actionability (i.e., 33%). Those with hearing loss watching these videos may understand the information; however, the videos may have very little influence on them making an action towards finding solutions to manage their hearing loss. In other words, watching these videos may not have any bearing towards help-seeking and/or hearing rehabilitation uptake. These results are consistent with our recent study on analysis of YouTube videos on hearing aids which also showed adequate understandability and poor actionability (Manchaiah et al., 2020b). It should be noted

that the actionability scores of the hearing aid videos were higher than the present study (i.e., 68%). That said, several actionability item scores on the hearing aid videos were low, indicating the need for improvement. Overall, these results indicate that the videos pertaining to hearing loss are not particularly effective in facilitating people with hearing loss in their journey through the acceptance and successful management of their hearing loss (Manchaiah, Stephens, & Meredith, 2011).

Some differences were noted in terms of understandability scores of videos uploaded by different sources. Videos uploaded by professionals were superior in understandability than other video sources, which is consistent with previous research in communication disorder videos (Bellon-Harn et al., 2019; Manchaiah et al., 2020b). However, there was no difference between video source and actionability indicating that all videos were lacking in enabling individuals to easily identify what they need to do. These results are also consistent with the previous literature (Bellon-Harn et al., 2019; Manchaiah et al., 2020b). It is disconcerting that actionability was inadequate because it suggests that these videos did not empower the viewer to take an action. In particular, it was surprising to see the poor actionability in the videos made by professionals since they are indeed trained to facilitate actions of individuals with health conditions and/or disabilities. It is difficult to draw firm conclusions because the context in which the videos were uploaded was not taken into consideration in this study. This may have played a crucial role in determining the understandability and actionability scores of these materials that are freely available to public. Overall, these results indicate that there is need for significant improvement in the video quality and content in order to facilitate behavior change in individuals with hearing

loss who may be watching these videos as source of information for their decision-making (Manchaiah et al., 2020a).

Study Limitations and Further Research

The study was focused on the source, content, understandability and actionability of YouTube videos related to hearing loss. However, it has a few limitations. First, the context (i.e., reason for creating and uploading) in which video was uploaded was not considered. This is a major drawback as the context can influence the content. Second, although measures were taken to reduce the search related bias by using the private mode when searching for videos, there may have still be some bias in YouTube searches which may have provide country specific (i.e., U.S.) search results. Third, in this study we only considered the 100 most frequently viewed videos after exclusion. Therefore, we only get a preliminary understanding of the content and these results should be seen as exploratory. Fourth, some of these videos may have misinformation related to hearing loss. However, this was not considered in the current study. Future studies can examine and quantify the misinformation by mapping the content to the evidence-base in the academic literature and/or clinical practice guidelines. Fifth, the PEMAT was designed to be used by lay people and health professionals alike. The raters in this study were faculty and doctoral students with a background in the area of audiology. Consequently, they rated the videos with background knowledge. Future studies should include non-clinical individuals with hearing loss and their significant other. Sixth, the scope of this study was broad as it focused on evaluating information related to all aspects of hearing loss. Hence, focusing on some specific content categories (e.g., causes, management options) pertaining to hearing loss may have provided more in-depth understanding. Finally, cultural context and appropriateness was not

considered. Future studies should examine the relationship among cultural appropriateness, usability and actionability. YouTube users tend to choose videos based on their interest rather than popularity of the videos. Hence, it would be interesting to study the content of more relevant YouTube videos based on specific topics (e.g., diagnosis, management), rather than its popularity.

Conclusions

By understanding the information from various sources to which clients are exposed, professionals can understand the presuppositions clients may have during clinical encounters. This is essential in developing appropriate and evidence-based information directed towards them. Results indicated that videos covered diverse content; however, the source of upload was linked to the type of content. The information provided by these videos seem to have good understandability, although the actionability of the information was not adequate. These results suggest that the users may not take any action to deal with their hearing loss although they understand the information presented in the YouTube videos. Future research considering how and why different sources promote types of information and utilize various platforms will further enhance our understanding of the role of online information in hearing healthcare. Due to the low actionability ratings, professional and members of healthcare organizations need to create additional high-quality resources that clearly identify a plan of action for the individual with hearing loss.

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642

643 **Table 1: Descriptive statistics of meta-data (i.e., number of views, video length, thumbs-up**

644 **and thumbs-down) in 100 most viewed hearing loss YouTube videos in English by their**

645 **source (Consumer=16; Professional=62; Media=22)**

646

	Mean	**Median**	**Min to Max**	**SD**	**SE**	**95% CI**	**Total**
Number of views							
Consumer	38,917	13,326	8,081 to 289,619	70,560	17,640	1,317 to 76,516	
Professional	43,497	19,124	7,822 to 487,297	74,438	9,453	24,593 to 62,400	
Media	40,327	15,599	8,318 to 174,208	47,439	10,114	19,293 to 61,360	
All	42,066	16,724	7,822 to 487,297	68,187	6,818	28,537 to 55,596	4,206,692
Video length (mm:ss)							
Consumer	7:03	5:10	1:11 to 18:09	5:23	1:20	4:11 to 9:55	
Professional	4:32	2:58	0:26 to 36:57	6:34	0:50	2:52 to 6:13	

Media	3:51	2:25	00:18 to 20:10	4:26	0:56	1:53 to 5:49	
All	4:47	3:06	00:18 to 36:57	6:02	00:36	3:36 to 5:59	7:56:00 (476 mins)
Thumbs-up							
Consumer	324	104	1 to 3,000	728	182	-64 to 712	
Professional	172	64	0 to 2,200	334	42	87 to 257	
Media	310	43	6 to 2,900	662	141	16 to 604	
All	227	64	0 to 3,000	497	49	128 to 325	22,716
Thumbs-down							
Consumer	8.75	3	1 to 76	18.2	4.5	1 to 18.4	
Professional	8.27	3.5	0 to 78	14.05	1.8	4.7 to 11.8	
Media	8.14	2	0 to 56	13.4	2.9	2.2 to 14	
All	8	3	0 to 78	14.5	1.4	5.4 to 11.2	832

Table 2: Percentage of videos presenting specific theme content in the 100 most viewed hearing loss related YouTube videos by their source and contents (Note: Items with significant differences based on Bonferroni corrected significance levels are highlighted)

Content	**Source category of video in %**				**Association with source**	
	All	**Consumer**	**Professional**	**Media**	**Chi square**	***p*-value**

Hearing mechanism	35	6	49	18	**13.4**	**0.001**
Type and degree of hearing loss	48	25	61	27	**11.6**	**0.003**
Symptoms of hearing loss	61	56	65	55	0.86	0.65
Medical or genetic condition associated with hearing loss	37	50	37	27	2.05	0.36
Causes of hearing loss	60	44	61	68	2.42	0.29
Effects of hearing loss on development	16	19	11	27	2.19	0.20
Consequences of hearing loss on individual' life and work	54	88	44	59	**10.2**	**0.006**
Consequences of hearing loss on communication partners'	35	63	27	36	6.9	0.032
Diagnosis or conformation of hearing loss	26	31	26	23	0.35	0.84
Treatment or management of hearing loss	60	67	61	50	1.47	0.48
Acceptance or coping	40	75	15	50	**23.7**	**<0.001**
Hearing loss prevention	24	25	21	32	1.06	0.89
Featuring a celebrity	9	19	2	23	**11.05**	**0.004**

652

653 **Table 3: Descriptive statistics of the Patient Education Materials Assessment Tool for**

654 **Audiovisual Materials (PEMAT-A/V) items**

655

PEMAT-A/V Factors and Items	Frequency (%)		
	Disagree	Agree	Not applicable
Sub-scale: Understandability			
Topic: Content			
Item 1: The material makes its purpose completely evident.	14	86	0
Topic: Word Choice & Style			
Item 3: The material uses common, everyday language.	6	94	0
Item 4: Medical terms are used only to familiarize audience with the terms. When used, medical terms are defined.	48	52	0
Item 5: The material uses the active voice.	8	92	0
Topic: Organization			
Item 8: The material breaks or "chunks" information into short sections.	20	73	7
Item 9: The material's sections have informative headers.	68	11	21
Item 10: The material presents information in a logical sequence.	13	87	0
Item 11: The material provides a summary.	25	68	7
Topic: Layout & Design			
Item 13: Text on screen is easy to read.	5	64	31
Topic: Use of Visual Aids			
Item 14: The material allows the user to hear the words clearly (e.g., not too fast, not garbled)	4	89	7

Item 18: The material uses illustrations and photographs that are clear and uncluttered.	5	45	50
Sub-scale: Actionability			
Item 20: The material clearly identifies at least one action the user can take.	42	58	0
Item 21: The material addresses the user directly when describing actions.	63	37	0
Item 22: The material breaks down any action into manageable, explicit steps.	88	12	0
Item 25: The material explains how to use the charts, graphs, tables, or diagrams to take actions.	67	7	26

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659 **Table 4: Patient Education Materials Assessment Tool for Audiovisual Materials (PEMAT-**
660 **A/V) scores across video source categories (Professional=24; Consumer=34; Television**
661 **based=19; Internet-based=23)**

662

Source	**Mean**	**Median**	**Min to Max**	**SD**	**SE**	**95% CI**
Understandability						
Consumer	72.8	73	44 to 100	16.8	4.2	63.9 to 81.8
Professional	80.6	82	27 to 100	15.7	2	73.6 to 84.6

Media	71.4	70	50 to 90	12.6	2.7	65.8 to 77
All	77.4	80	27 to 100	15.7	1.6	74.2 to 80.5
Actionability						
Consumer	34.2	50	0 to 66	28.6	7.2	18.9 to 49.4
Professional	33.1	29	0 to 100	30.4	3.9	25.4 to 40.9
Media	22.7	12.5	0 to 75	27.3	5.8	10.6 to 34.8
All	31	25	0 to 100	29.5	2.9	25.1 to 36.9